Nanoscience and Nanotechnology in Scopus: Journal Identification and Visualization

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Introduction

This document presents a new query for the retrieval of information about Nanoscience & Nanotechnology (N&N) based on the combination of previously published search strategies, contrasted by the scientific community. It led us to identify 80 core journals of N&N in Scopus, then map and analyze the underlying structure of N&N output using visualization techniques. N&N is established as a productive young discipline, crosscutting other fields in its rapid evolution, for which reason it has poorly defined limits to date, and needs some time to consolidate its identity as a discipline.

Materials & Methods

On 06/11/2012 we launched a search against the Scopus database using the combination of different queries proposed previously. Query 1 included terms with the root nano*, while excluding any terms containing the root nano* yet not related with N&N. To this end, we referred to the combination of proposals made by Noyons et al., 2003; Glänzel et al., 2003; Huang et al., 2003; and Meyer, Debackere and Glänzel, 2010**.** In turn, query 2 combined instruments and processes utilized in N&N with different types of materials, functions and other terms, in the wake of proposals by Noyons et al., 2003, Glänzel et al., 2003, Kostoff, Koytcheff and Lau, 2007 and Porter et al., 2008. Finally, query 3 included a series of terms related with N&N and was based on the work of Noyons et al., 2003; Glänzel et al., 2003; Huang et al., 2003; Kostoff, Koytcheff and Lau, 2006; Porter et al., 2008; and Lv et al., 2011. The combination of these three searches led to a new query which we believe can be perfectly adopted for the identification of N&N documents in any specialized or multidisciplinary database (Annex). It is available too in Scopus format at: *http://www.scimago.es/benjamin/nanoquery.pdf*

Results

The total number of retrieved documents was 142,102: 70,726 articles, 30,314 conference papers and 4,062 reviews. The total number of references was 2,903,543. To identify the core journals, we selected those that reflected over 1% of total citation, eliminating multidisciplinary journals such as *Nature*, *Science* and *PNAS*. We aggregated all journals covered by Scopus that had the term "nano" in their titles and that had been cited at least once in 2010, with the understanding that the term "nano" in a title indicates that the journal pertains to the discipline of N&N and has been previously reviewed and validated by the scientific community (Schummer, 2004). The core journals of N&N identified amount to 80 (Table 1). Its visualization was achieved by means of Vosviewer (Van Eck & Waltman, 2010). It draws together the journals in four clusters (Figure 1). The correspondence between colors and journals is indicated in Table 1: red is 1, green is 2, blue is 3 and yellow is 4.

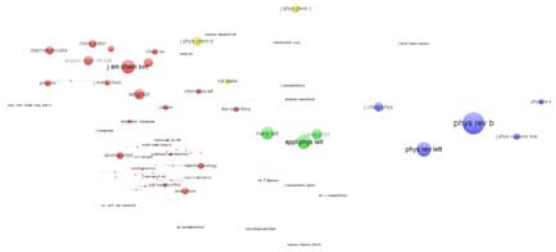

Figure 1. Scopus core journals in N&N

Discussion

The 80 journals indicated constitute the core group of N&N publications. However, for future reference, we ought to include in brackets the other 11 that also had the term "nano" in their title, since they will eventually be cited as well. Indeed, three of them appear as cited in the year 2010 in the SCImago Journal & Country Rank (Scimago, 2007), but not with reference to the documents we downloaded as the basis of our study. For a more complete view of core N&N journals, the listing and display offered here should be compared with a future contribution that also takes into account information from the Web of Science. One might expect a clearly outlined map of N&N journals in Scopus, given that core journals configure the basis of the map. Surprisingly, this is not the case. At first glance, there appears a fragmentation of journals revealing two major groups: Physics, condensed matter on the one hand, and Chemistry multidisciplinary on the other. This depiction implies that N&N is a highly transversal discipline, and that its borderlines are not well established.

Conclusions

N&N configure a highly transversal discipline, whose borders appear to defy delimitation. While most N&N documents are published in Physics and Chemistry journals, they may also be included in journals specializing in Materials Science or other slippery subject areas that may include the term "nano" in their title, and by virtue of this prefix, come to form the ranks of this discipline in high gear. Just 50 years old, it can be seen as a field in constant evolution, in parallel with the growth of journals who divulge its findings. It is a matter of time, and space, but N&N will eventually have its own profile in Scientometric mappings, That is, it will consolidate an identity as a distinctive scientific discipline, and be delimited as a separate category in databases such as Scopus. Our analysis ventured into multidisciplinary databases by different means, recovering more documents than other attempts reported previously. To our knowledge, this is the first research study to combine all the approaches to N&N published to date, and discarding duplications. The sensitivity of this new type of query makes it adaptable to any database, as long as the syntax and operators are adjusted accordingly.

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Annex

Query: ((nano* AND NOT (nano2 OR nano3 OR nano4 OR nano5 OR nanosecon* OR nano-secon* OR nanogram* OR nano-gram* OR nanomol* OR nanophtalm* OR nanomeli* OR nanogeterotroph* OR nanoplankton* OR nanokelvin* OR nanocurie OR nano-curie OR nanos OR nanos1 OR nanoproto* OR nanophyto* OR nanoflagel* OR wnanomol* OR wnano-curie* OR wnanocurie* OR anos1 OR nanobacter* OR nano-bacter* OR nanospray* OR nano-spray* OR plankton* OR n*plankton OR m*plankton OR b*plankton OR p*plankton OR z*plankton OR nanoalga* OR nanoprotist* OR nanofauna* OR nano*aryote* OR nanoheterotroph* OR "nanook of the north" OR nano-bible)) OR ((atomic-force-microscop* OR afm OR transmission-electron-microscop* OR tem

OR scanning-tunneling-microscop* OR tunnel*-microscop* OR stm OR scanning-electron-microscop* OR sem OR self-assembl* OR selfassembl* OR self-organiz* OR edx OR energy-dispersive-x-ray OR energy-dispersive-x-ray-spectroscop* OR scanning-probe-microscop* OR electron-energy-loss-spectroscop* OR eels OR high-resolution-tem OR high-resolution-transmission-electron-microscop* OR uv-vis OR x-ray-photoelectron* OR x-ray-photoelectron* OR xps OR uv-visible-spectroscop* OR Ultraviolet-visible-spectroscop* OR hrtem OR Chemical-force-microscop* OR CFM OR scanning-force-microscop* OR SFM OR NSOM OR NEAR-FIELD-SCANNING-OPTICAL-MICROSCOP* OR SNOM OR "chemical vapor deposition" OR CVD OR " chemical vapour deposition " OR XRD OR " x-ray diffraction " OR " differential scanning calorimetry " OR DSC OR " molecular beam epitaxy " OR "mbe")) AND (surface* OR film* OR layer* OR substrate* OR roughness OR monolayer* OR mono-layer* OR molecul* OR structure* OR resolution OR etch* OR grow* OR silicon OR si OR silicium OR "silicon oxide" OR sio2 OR deposit* OR particle* OR formation OR tip OR atom* OR gold OR au OR polymer* OR copolymer* OR co-polymer* OR gaas OR inas OR superlattice* OR adsorption OR absorb* OR island* OR size OR powder* OR resolution OR quantum* OR multilayer* OR multi-layer* OR array* OR mater* OR supramolecular* OR biolog*)) OR (quantum-dot* OR quantum-wire* OR quantum-well* OR quantum-effect* OR "quantum computing" OR coulomb-blockade* OR coulomb-staircase* OR molecul*-motor* OR molecul*-ruler* OR molecul*-device* OR "molecular beacon" OR molecular-sensor* OR "molecular engineering" OR molecular-electronic* OR molecular-manufact* OR "molecular modeling" OR "molecular simulation" OR molecul*-wire* OR molecular-sieve* OR biosensor* OR bionano* OR hipco OR molecular-template* OR carbon-tub* OR carbontub* OR bucky-tub* OR buckytub* OR fulleren* OR biochip* OR dna-cmos* OR graphen* OR graphit* OR single-molecul* OR langmuir-blodgett OR pdms-stamp* OR pebbles OR nems OR quasicrystal* OR quasi-crystral* OR sol-gel* OR solgel* OR dendrimer* OR soft-lithograph*)). We limited the documents of interest to those published within the year 2010 and to articles, conference papers and reviews.

Table 1. Scopus core journals in N&N

Abbreviated journal title	*Cites*	*% Cites*	*Clusters*
phys rev b	184,370	13.879	3
phys rev lett	81,585	6.141	3
appl phys lett	75,445	5.68	2
j am chem soc	74,126	5.58	1
nano lett	60,151	4.528	2
Langmuir	42,982	3.236	1
j appl phys	42,849	3.226	2
j phys chem b	35,639	2.683	4
Angew chem int edit	35,435	2.67	1
adv mater	32,163	2.42	1
j chem phys	31,114	2.342	3
macromolecules	28,069	2.113	1
j phys chem c	27,568	2.075	4
Chem. Mater	24,481	1.84	1
biomaterials	21,191	1.6	1
anal chem..	19,287	1.45	1
j phys-condens mat	17,648	1.328	3
Chem. Commun	16,912	1.27	1
Polymer	16,692	1.257	1
Nanotechnology	16,346	1.23	1
Chem. Rev	15,008	1.13	1
nat mater	14,218	1.07	4
j mater chem.	13,431	1.011	1
physica e	12,658	1.008	3
Carbon	12,150	1.006	1
thin solid films	12,006	1.001	1
Chem. phys lett	11,836	1	1
nat nanotechnol	7,697	0.579	1
Acs nano	6,242	0.47	1
j nanosci nanotechno	3,799	0.286	1
j nanopart res	1,800	0.135	1
Nanomedicine	1,605	0.121	1
ieee t nanotech	968	0.073	1
nano today	820	0.062	1
Nanoscale res lett	700	0.053	1
nano res	643	0.048	1
microfluid nanofluid	564	0.042	2
Int j nanomed	548	0.041	1
j comput theor nanos	435	0.033	1
Nanomed-nanotechnol	352	0.026	1
j biomed nanotechnol	328	0.025	1
j. nanobiotechnology	299	0.023	1
Nano	293	0.022	1
curr nanosci	272	0.02	1
Nanoscale	266	0.02	1
Nanotoxicology	251	0.019	1
ieee t nanobiosci	232	0.017	1
Dig j nanomater bios	211	0.02	1
Int j nanotechnol	198	0.015	1
j nanomater	147	0.011	1
j nanophotonics	133	0.01	4
Int. j. nanosci.	127	0.01	2
Synth react inorg m	121	0.009	1
Wires nanomed nanobi	75	0.006	1
Micro nano lett	74	0.006	2
photonic nanostruct	71	0.005	4
nanosc and nanotech – asia	68	0.005	1
j exp nanosci	66	0.005	1
Fuller nanotub car n	63	0.005	1
j nanoelectron optoe	53	0.004	2
nanosc microsc therm	51	0.004	2
Nanoethics	48	0.004	1
j micro-nanolith mem	47	0.004	2
recent pat nanotech	36	0.003	1
Nami jishu yu jingmi gongcheng	33	0.002	1
j laser micro nanoen	30	0.002	2
j nano res	25	0.002	1
nano biomed. eng.	23	0.002	1
Int. j. nanomanufacturing	21	0.002	1
Nanotechnology law & business	20	0.002	1
Iet nanobiotechnol	18	0.001	1
e-j. surf. sci. nanotech.	16	0.001	1
ieee nanotechnol. mag.	16	0.001	1
Int. j. nanoparticles	15	0.001	2
nanotechnol. russ.	14	0.001	4
nanosci nanotech let	12	0.001	1
j. bionanosci.	11	0.001	2
j. nanostruct. polym. Nanocomp.	9	0.001	1
nanotechnol. sci. appl.	6	0.001	1
proc. Inst mech eng part nj n&n.	5	0.001	1